MULTIMEDIA UNIVERSITY STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

BST1034 – STATISTICS FOR MANAGERS

(All sections / Groups)

16 FEBRUARY 2023
9.00 am – 11.00 am
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **8** printed pages excluding the cover page, with **4** questions only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use non-programmable scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

Question 1

(a) Consider the following set of a sample data:

26.9	26.7	27.0	31.4	29.0	26.6
32.1	28.5	35.2	27.3	29.9	27.4

(i) Compute the mean and standard deviation for these sample data.
(5 marks)

(ii) Calculate the coefficient of variation for these sample data.
(2 marks)

(b) The following data shows the quantities and prices of four type of products purchased by a company in year 2019 and year 2020.

Product	2019		2020	
	Price (RM)	Quantity	Price (RM)	Quantity
A	6.50	120	7.70	135
B	2.30	90	2.90	95
C	13.20	55	15.60	60
D	9.70	70	9.90	85

(i) Calculate the Laspeyres price index for the year of 2020 by using 2019 as the base year.
(3 marks)

(ii) Calculate the Paasche quantity index for the year of 2020 by using 2019 as the base year.
(3 marks)

(c) A Financial Consultant has classified his clients according to their gender and the composition of their investment portfolio (primarily bonds, primarily stocks, or a balanced mix of bonds and stocks). The proportions of clients falling into the various categories are shown in the following probability distribution table:

Portfolio Composition

Gender	Bonds	Stocks	Balanced
Male	0.18	0.20	0.25
Female	0.12	0.10	0.15

(i) calculate the probability that the client selected is male, if the client has a balanced portfolio.
(3 marks)

(ii) calculate the probability that the client selected has a balanced portfolio, if the client is male.
(3 marks)

Continued...

(d) In a year, the average number of flying hours for an aircraft was found to be 2389. Assume a normal distribution with a standard deviation of 300 hours.

(i) What proportion of aircraft flew more than 2000 hours during the year?

(3 marks)

(ii) What proportion of aircraft flew between 2000 and 2400 hours during the year?

(3 Marks)

(Total: 25 marks)

Question 2

(a) A group of researchers would like to conduct a research on young working adults' monthly expenses. Based on past record the average monthly expenses of young working adults in Melaka is RM1570 in 2020. Recently, the researchers have selected a random sample of 25 young working adults from Melaka and revealed that the mean monthly expenses is RM1748 with a standard deviation of RM260. At 0.05 significance level, test if the average monthly expenses has increased compared to 2020.

(12 marks)

(b) The researchers had rearranged the data according to gender. The following is the information obtained

(c)

	Male	Female
Mean	RM1850	RM1680
Standard deviation	RM320	RM300
Sample size	10	15

At 0.01 significance level and assume equal variances, test if the average monthly expenses of male young working adults is higher than the average monthly expenses of female young working adults.

(13 marks)

(Total: 25 marks)

Continued...

Question 3

(a) A consumer organization was concerned about the differences between the advertised sizes of containers and the actual amount of product. In a preliminary study, six packages of three different brands of margarine that are supposed to contain 500 ml were measured. The differences from 500 ml are measured. The collected data was analysed and the partially completed ANOVA table is shown below:

Summary

Groups	Count	Mean	Variance
Brand A	6	1.333	1.8667
Brand B	6	2.5	2.3
Brand C	6	2.667	1.4667

ANOVA

Source of Variation	*SS*	*df*	*MS*
Between Groups	***	***	***
Within Groups	28.1667	15	***
Total	***	17	

(i) Compute the sum of square between groups (SSB) and then complete the ANOVA table. (6 marks)

(ii) If the populations have equal variances and are normally distributed, is there any difference in the average differences between the three brands at 5% significance level? (7 marks)

(b) A study of educational levels of voters and their political party affiliations yielded the following results.

Educational Level	Party Affiliation		
	Democratic	Republic	Independent
Did not complete high school	40	20	10
High School	30	35	15
Graduate	30	45	25

Do the data provide sufficient evidence to conclude that the party affiliation independent of the educational level of the voters at 0.05 significance level? (12 marks)

(Total: 25 marks)

Continued...

Question 4

The sales manager of an automobile company wants to estimate the total annual sales of a region. Several factors appears to be related to sales, including retail outlets, number of cars registered, personal income, average age of automobiles and number of bosses. The data were gathered for a recent year. The partially completed computer output of the regression model with 5 independent variables is as follows:

ANOVA

Source of Variation	*SS*	*df*	*MS*
Regression	1593.81	***	***
Residual	9.08	4	***
Total		***	

Variable	Coefficient	t - stat
Intercept	-19.672	-3.63
Outlets	-0.000629	-0.24
Cars	1.7399	3.15
Income	0.40994	9.35
Age	2.0357	2.32
Bosses	-0.0344	-0.18

(a) State the multiple regression equation for the above information.

(2 marks)

(b) Complete the ANOVA table given.

(4 marks)

(c) Compute the R-Square and explain.

(4 marks)

(d) Perform a *F* test at 5% significance level to determine whether the model is useful in predicting the house size.

(7 marks)

(e) Test the regression coefficients individually. Would you consider omitting any variables? If so, which one? Use 0.05 significance level.

(8 marks)

(Total: 25 marks)

End of Paper

APPENDICES:

I. STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Ungrouped Data:

Sample Mean, $\bar{x} = \frac{\sum x}{n}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}}$

Grouped Data:

Sample Mean, $\bar{x} = \frac{\sum fx}{\sum f}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum fx^2}{\sum f - 1} - \frac{(\sum fx)^2}{\sum f(\sum f - 1)}}$

Median $= L_m + \left[\frac{\left(\frac{\sum f}{2} - F_{m-1}\right)}{f_m}\right]c$ Mode $= L_m + \left[\frac{(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}\right]c$

B. PROBABILITY DISTRIBUTION

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = np and variance = VAR(X) = npq where $q = 1-p$

Normal Distribution

If $X \sim N(\mu, \sigma)$ where E(X) = μ and VAR(X) = σ^2, then $Z = \frac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

If σ known, $(100-\alpha)\%$ Confidence Interval for Population Mean, μ: $\bar{x} \pm Z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$

If σ unknown, $(100-\alpha)\%$ Confidence Interval for Population Mean, μ: $\bar{x} \pm t_{\alpha/2,n-1}\frac{s}{\sqrt{n}}$

$(100-\alpha)\%$ Confidence Interval for Population Proportion, π: $p \pm Z_{\alpha/2}\sqrt{\frac{p(1-p)}{n}}$

Sample Size Determination for Population Mean: $n = \frac{(Z_{\alpha/2})^2\sigma^2}{E^2}$

Sample Size Determination for Population Proportion: $n = \dfrac{(Z_{\alpha/2})^2\, p(1-p)}{E^2}$

D. HYPOTHESIS TESTING

One Sample Mean Test

***Z*-test:** $Z = \dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$ ***t*-test:** $t = \dfrac{\bar{x} - \mu}{\dfrac{s}{\sqrt{n}}}$

One Sample Proportion Test

$$Z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$$

Two Sample Mean Test

***Z*-test:** $Z = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$

***t*-test:** $t = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$ where $s_p = \sqrt{\dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$

Two Sample Proportion Test

$$Z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left[\dfrac{1}{n_1} + \dfrac{1}{n_2}\right]}} \qquad \text{where} = \bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

E. ANALYSIS OF VARIANCE

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n_j}\left(X_{ij} - \bar{\bar{X}}\right)^2 \qquad SSB = \sum_{i=1}^{k} n_i\left(\bar{X}_i - \bar{\bar{X}}\right)^2$$

$$SSW = \sum_{i=1}^{k}(n_i - 1)s_i^2 \quad \text{or} \quad SSW = \sum_{i=1}^{k}\sum_{j=1}^{n_j}\left(x_{ij} - \bar{x}_i\right)^2$$

F. CHI-SQUARE ANALYSIS

Expected cell frequencies for Independent Test: $E_i = \dfrac{Row\ total \times Column\ total}{N}$

Chi-Square test statistic: $\chi^2 = \sum \dfrac{(O_i - E_i)^2}{E_i}$

O_i = Observed frequency in a particular cell

E_i = expected frequency in a particular cell

G. REGRESSION ANALYSIS

Correlation Coefficient: $r = \dfrac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$

Simple Linear Regression: $Y = a + bX$ where $b = \dfrac{\sum xy - \dfrac{\sum x \sum y}{n}}{\sum x^2 - \dfrac{(\sum x)^2}{n}}$ and

$a = \bar{y} - b\bar{x}$

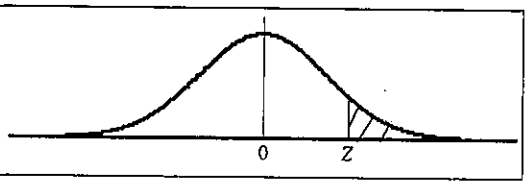
H. INDEX NUMBERS

Simple Price Index $P = \dfrac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \dfrac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Simple Aggregate Price Index $P = \dfrac{\sum p_t}{\sum p_0} \times 100$	**Paasche Quantity Index** $P = \dfrac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \dfrac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$
Paasche Price Index $P = \dfrac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \dfrac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

II. STATISTICAL TABLE

Table 1

The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000